

WHAT IS CLAIMED IS:

1. A solids separation system comprising:

a material entry line;

an entry valve attached to the entry line;

5 a hydrocyclone comprising

a tubular body having a top end cap and a bottom end cap,

a first inlet proximal to the top end cap,

a spin can positioned within a top end of the tubular body below the top  
end cap, and

10 an outlet tube transversing the spin can;

a fluid outlet line having one end attached to the outlet tube;

a solids outlet line exiting a bottom end of the hydrocyclone;

a solids exit valve in fluid communication with the solids outlet line on a first end;

15 a choke in fluid communication with the solids outlet line when the solids exit  
valve is open; and

a solids exit line attached to the choke.

2. The solids separation system of claim 1, further comprising a fluid exit valve connected to the fluid outlet line on a first end and to a fluid exit line on a second end.

3. The solids separation system of claim 1, wherein the separation system is mounted is a skid frame.

5 4. The solids separation system of claim 1, wherein the entry valve is a ball valve.

5. The solids separation system of claim 6, wherein the ball valve is manually operated.

6. The solids separation system of claim 1, wherein the entry valve is a ball valve, a tapered plug valve, or a gate valve.

10 7. The solids separation system of claim 1, further comprising a second inlet proximal to the bottom end cap.

8. The solids separation system of claim 7, wherein the second inlet is in a mirror image location about the tubular body horizontal midplane.

15 9. The solids separation system of claim 8, wherein the second inlet is capped with a blind flange.

10. The solids separation system of claim 1, wherein an upper half of the tubular body is substantially similar to a lower half of the tubular body when the tubular body is rotated 180° about the longitudinal axis of the tubular body.

20 11. The solids separation system of claim 1, wherein the spin can has an entry aperture.

12. The solids separation system of claim 11, wherein the entry aperture of the spin can is aligned with the first inlet.

13. The solids separation system of claim 1, wherein the spin can comprises an inner cylindrical tube, an outer cylindrical tube and an interconnecting bulkhead.

5 14. The solids separation system of claim 13, wherein the outlet tube transverses the interior bore of the inner tube.

15. The solids separation system of claim 1, wherein the outlet tube extends into the tubular body below the spin can.

10 16. The solids separation system of claim 1, wherein the solids exit valve is a ball valve.

17. The solids separation system of claim 1, further comprising an actuator attached to the choke on an opposed side of the choke from the solids exit line.

18. The solids separation system of claim 17, wherein the choke has as a choke gate attached to a reciprocating actuator rod.

15 19. The solids separation system of claim 1, wherein the choke has a pressure balanced choke gate.

20. The solids separation system of claim 1, wherein the choke has a choke gate with at least one flow passage transversing the choke gate.

21. A solids separation system comprising:

a material entry line;

an entry valve attached to the entry line;

a hydrocyclone comprising

5 a tubular body having a top end cap and a bottom end cap,

a first inlet proximal to the top end cap,

a spin can positioned within a top end of the tubular body below the top  
end cap, and

an outlet tube transversing the spin can;

10 a fluid outlet line having one end attached to the outlet tube;

a solids outlet line exiting a bottom end of the hydrocyclone;

a solids exit valve in fluid communication with the solids outlet line on a first end;

a choke in fluid communication with the solids outlet line when the solids exit  
valve is open;

15 a solids exit line attached to the choke; and

an actuator attached to the choke on an opposed side of the choke from the solids  
exit line.

22. The solids separation system of claim 21, further comprising a fluid exit valve connected to the fluid outlet line on a first end and to a fluid exit line on a second end.

23. The solids separation system of claim 21, further comprising a second inlet proximal to the bottom end cap.

5 24 The solids separation system of claim 23, wherein the second inlet is in a mirror image location about the tubular body horizontal midplane.

25 The solids separation system of claim 24, wherein the second inlet is capped with a blind flange.

10 26 The solids separation system of claim 21, wherein an upper half of the tubular body is substantially similar to a lower half of the tubular body when the tubular body is rotated 180° about the longitudinal axis of the tubular body.

27. The solids separation system of claim 21, wherein the spin can has an entry aperture.

15 28. The solids separation system of claim 27, wherein the entry aperture of the spin can is aligned with the first inlet.

29. The solids separation system of claim 21, wherein the spin can comprises an inner cylindrical tube, an outer cylindrical tube and an interconnecting bulkhead.

30. The solids separation system of claim 29, wherein the outlet tube transverses the interior bore of the inner tube.

20 31. The solids separation system of claim 21, wherein the outlet tube extends into the tubular body below the spin can.

32. The solids separation system of claim 21, wherein the choke has as a choke gate attached to a reciprocating actuator rod.

33. The solids separation system of claim 21, wherein the choke has a choke gate with at least one flow passage transversing the choke gate.

5 34. A solids separation system comprising:

a material entry line;

an entry valve attached to the entry line;

a hydrocyclone comprising

a tubular body having a top end cap and a bottom end cap,

10 a first inlet proximal to the top end cap,

a spin can positioned within a top end of the tubular body below the top end cap, the spin can having an aperture aligned with the first inlet, and

an outlet tube transversing the spin can and extending into the tubular body below the spin can;

15 a fluid outlet line having one end attached to the outlet tube;

a fluid exit valve connected to the fluid outlet line on a first end and to a fluid exit line on a second end

a solids outlet line exiting a bottom end of the hydrocyclone;

a solids exit valve in fluid communication with the solids outlet line on a first end;

a choke in fluid communication with the solids outlet line when the solids exit valve is open;

a solids exit line attached to the choke; and

an actuator attached to the choke on an opposed side of the choke from the solids exit line.

35. The solids separation system of claim 1, further comprising a second inlet proximal to the bottom end cap of the tubular body.

36 The solids separation system of claim 35, wherein the second inlet is in a mirror image location about the tubular body horizontal midplane.

37. The solids separation system of claim 35, wherein the second inlet is capped with a blind flange.

38. The solids separation system of claim 34, wherein an upper half of the tubular body is substantially similar to a lower half of the tubular body when the tubular body is rotated 180° about the longitudinal axis of the tubular body.

39. The solids separation system of claim 34, wherein the choke has a choke gate with at least one flow passage transversing the choke gate.

40. A process for removing solid particles from flowing fluids, the process comprising the steps of:

(a) connecting a wellhead outlet and a fluid entry line of a solids separation system, the solids separation system comprising

- 5 (i) an entry valve attached to the entry line,
- (ii) a hydrocyclone having
  - a tubular body having a top end cap and a bottom end cap,
  - a first inlet proximal to the top end cap,
  - a spin can positioned within a top end of the tubular body below
  - 10 the top end cap, and
  - an outlet tube transversing the spin can;
- (iii) a fluid outlet line having one end attached to the outlet tube,
- (iv) a solids outlet line exiting a bottom end of the hydrocyclone,
- (v) a solids exit valve in fluid communication with the solids outlet
- 15 line on a first end,
- (vi) a choke in fluid communication with the solids outlet line when the solids exit valve is open, and
- (vii) a solids exit line attached to the choke;
- (b) connecting the fluid outlet line to a fluid handling facility;



(c) opening the entry valve to allow fluid flowing from the wellhead into the spin can of the hydrocyclone;

(d) routing a depariculated fluid from the outlet tube through the fluid outlet line and into the fluid handling facility;

5 (e) collecting a settlement of solid particles at the bottom end of the hydrocyclone;

(f) closing the choke;

(g) opening the solids exit valve whenever the settlement of solid particles reaches a predetermined amount;

10 (h) opening the choke slowly to remove most of the settlement of solid particles; and

(i) closing the solids exit valve once most of the settlement of solid particles has been removed from the bottom end of the hydrocyclone.

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